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Effects of Different Drills Upon the Improvement of Agility of Football Players

Radford F. Taylor

EFFECTS OF DIFFERENT DRILLS UPON THE IMPROVEMENT OF AGILITY OF FOOTBALL PLAYERS

BY

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EFFECTS OF DIFFERENT DRILLS UPON THE IMPROVEMENT

OF AGILITY OF FOOTBALL PLAYERS

This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Science, and is acceptable as meeting the thesis requirements for this degree, but without implying that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Thesis Advisor	Date
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Abstract

RADFORD F. TAYLOR

Under the supervision of Professor Glenn E. Robinson and Dr. Paul Brynteson

Subjects for this study were 55 volunteers from the SDSU football team. The subjects were divided into four groups, three experimental and one control. Each group was assigned randomly an experimental set of drills selected from those frequently used by coaches. They conditioned six weeks, four times weekly, for fifteen minutes each day.

The drill sequences were designated: Group A--quick drills and 10-second drills; Group B--wave drills; Group C--speed drills and sprints; and Group D was the control group. In addition to the drills administered to the three treatment groups, all four groups took part in weight lifting three days per week and distance running two days per week.

The McCauliff Agility Components Test was administered prior to the program and at the conclusion of the six-weeks training program. The subjects' best times on each test were used to compute group means. The analysis of variance resulted in an F ratio of 2.47 which was not significant at the .05 level of confidence; however, it exceeded the .10 level.

ACKNOWLEDGEMENTS

The writer wishes to express his gratitude to the subjects who gave their time, effort, and support in making this study possible, and to his wife for her support, encouragement and unyielding patience throughout the study.

To his advisors, Professor Glenn E. Robinson and Dr. Paul Brynteson, the writer also wishes to express his sincere appreciation for their valuable assistance and supervision in the completion of this study.

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INTRODUCTION

Chapter I

INTRODUCTION

Significance of the Study

> The deafening roar from the crowd swirls.... hovers above the football field....Time left 0:08 seconds--one play; and the score is 22-25....ball on twenty-yard line....a pass to the halfback.... halfback rushes for the end zone....one defensive man between him and victory....Defensive man waits, watches, and then brings the pass receiver's aspirations crashing.[1]

Is a lack of ability to change direction of movement quickly as displayed in the hypothetical situation above the case with many of our athletes in all sports today? Is agility a quality that could be developed and improved in an individual? Are there practice drills that would have increased the running back's innate ability to change direction of movement more quickly? Could a few minutes spent in practice have won the game? Allen answers positively; agility and quickness can be taught or improved through control drills which put a player into realistic football situations.[2] This same concept was emphasized by Todannio's study which found that one group which worked on conditioning drills every day was able to perform a shuttle run

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[1]Hypothetical situation set up for introduction by Radford F. Taylor, 1973.

[2]George Allen, Encyclopedia of Football Drills (New York: Prentice Hall Inc., 1954), p. 15.

more rapidly than the other groups that did not work out at all.[3]

Keller stated in his study that in football more than in any other sport one needs the ability to move from one position to another quickly in order to achieve success in the game.[4] Graves wrote that there is no facet of the game as important as that of agility once the whistle blows.[5] Therefore, from evidence in literature that relates to agility and consultation, this investigator has found that coaches of many sports have put into their in-season and off-season training programs agility drills designed to improve agility. Broyles said at the Texas Coaching Clinic in 1966 that when he went to the University of Arkansas he started an agility program because of the sheer need for quickness and maneuverability of players in changing direction rapidly.[6]

Many systems for the improvement of agility have been subjective with the applier employing ideas on a trial-and-error basis. Dickie wrote that when it comes to improving agility whichever drill that works best in the situation should be used.[7]

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[3]Dominick A. Toddanio, "Effects of Daily Fifteen Minute Period of Calisthentics upon Physical Fitness of Fifth Grade Boys and Girls," Research Quarterly, 37:276, May, 1966.

[4]L. F. Keller, "The Relationship of Quickness of Body Movement to Success in Athletics," Research Quarterly, 13:146-7, May, 1962.

[5]Ray Graves, Guide to Modern Football Defense (West Nyack, New York: Parker Publishing Co., 1966), p. 135.

[6]Frank Broyles, "A New Program in a New School," Texas Coach, 10:26, September, 1966.

[7]Doug Dickie, "Aggressiveness in Your Defense," Texas Coach, 11:21, September, 1968.

This study was undertaken with the intent of providing coaches with objective and practical knowledge concerning the effects of selected, non-contact drills upon the agility of student athletes.

Should agility be significantly affected by one or more of the drill sequences, the information could be used by coaches concerning the selection of different drills and sequences of drills to be utilized in practices or out-of-season training programs. Coaches would have the opportunity to become more scientific and objective in their attempts to improve the agility of the participants.

Statement of the Problem

The purpose of this study was to compare the effects of selected non-contact drills upon the improvement of agility as measured by the McCauliff Agility Components Test.[8]

Hypothesis

The following hypothesis was investigated: There is no significant difference in the change in agility among the groups employing different non-contact sequences.

Definition of the Terms

Agility. McCauliff defines agility as the ability to change direction or position of the body through large range of movement.[9]

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[8]C. Elizabeth McCauliff, "A Test of Selected Agility Components" (unpublished Doctor's dissertation, Springfield College, Springfield, Massachusetts, 1968), pp. 37-38.

[9]Ibid., p. 27.

Willgoose defines agility as being able to make wide range of movement easily.[10] Wincie defines agility as the ability to move with both speed and accuracy.[11] Barrow defines agility as the ability to change direction rapidly and accurately.[12] Spackman defines agility as the ability to move any part of the body quickly and with immediate nimbleness.[13]

For this study, the investigator defined agility as the ability of an athlete to move quickly and accurately with the changing of position or direction of the body through a large range of movement.

Large range of movement. Movement of the body which involves primarily the large muscle groups of the legs as a source of power and the large muscle groups of the rest of the body as a source of additional power and body equilibrium.[14]

Flexibility. Flexibility is the ability to repeat flex or

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[10]Carl E. Willgoose, Evaluation in Health Education and Physical Education (New York: McGraw Hill Book Co., 1961), p. 16.

[11]Harold M. Barrow and Rosemary McGee, A Practical Approach to Measurement in Physical Education (Philadelphia: Lea and Febriger, 1964), p. 118.

[12]Ann Carruth Wincie, "An Analysis of Motor Ability and Relationship to Constitutional Body Patterns of College Women," Evaluation of Health Education and Physical Education (New York: McGraw Hill Book Co., 1961), p. 25.

[13]Robert R. Spackman, Conditioning for Football (Springfield, Illinois: Charles & Thomas Publisher, 1968), p. 33.

[14]Edwin A. Fleishman, Examiner's Manual for the Basic Fitness Test (Englewood Cliffs, New Jersey: Prentice Hall Inc., 1964), p. 31.

stretching movement either through short or long movements quickly.[15]

Coordination. Coordination is one of the basic physical factors in all performances through harmonious integrating action of various parts and processes of the body to react in an agile and effective manner.[16]

Fundamental athletic position. A position requiring that each subject stand with the feet approximately shoulder's width apart, weight distributed evenly on the balls of the feet, knees slightly bent, back straight, head erect, and eyes directed forward.[17]

Repetition. The performance of one change of direction in an agility drill.[18]

Set. The performance of a specific number of repetitions of an agility drill.[19]

Limitations of the Study

1. Subjects used were 55 members of the SDSU football squad

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[15] Ibid., p. 32.

[16] Barrow and McGee, op. cit., p. 114.

[17] Paul "Bear" Bryant, Building a Championship Football Team (Englewood Cliffs, New Jersey: Prentice Hall Inc., 1960), pp. 209, 226-7.

[18] C. L. Barnhart, The American College Dictionary (New York: Random House, 1961), p. 1028.

[19] Ibid., p. 1108.

involved in a voluntary off-season program.

2. No attempt was made to control subject's participation in physical activity programs in addition to the one administered by the investigator during the off-season training program.

3. No attempt was made to regulate sleep, diet, and regular living habits of these subjects.

4. The investigator did not evaluate the extent of motivation of each subject.

5. No attempt was made to control the learning which may have taken place from the subject's observation of the performance of the others running through the test pattern.

CHAPTER II

PROCEDURE

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PROCEDURE

Source of Data

Sixty subjects were involved originally in this study and were volunteers for the off-season football training program at South Dakota State University. A total of five subjects were dropped because of schedule conflicts and for a lack of interest; so that the data obtained from 55 subjects were included for the study.

Organization of Study

The 55 subjects were divided into four groups and equated on the best score each subject obtained on the pre-test employing the McCauliff Agility Component Test. There were three groups of 14 subjects and one group of 13 subjects established. The groups (A, B, C, and D) randomly were assigned treatments by the track pill-box method. The "quick drill" treatment was assigned to Group A; the "wave drill" treatment was assigned to Group B; Group C was assigned the "speed drill" treatment; and Group D became the control group. The investigator met with the subjects and explained the purpose of the study and the procedures on January 8, 1974.

The McCauliff Test[1] was employed as the evaluation tool for the

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[1]C. Elizabeth McCauliff, "A Test of Selected Agility Components" (unpublished Doctor's dissertation, Springfield College, Springfield, Massachusetts, 1968), pp. 37-38.

pre-test and also for the post-test. The pre-test was administered on January 9 and 10 consecutively. The treatment period began Monday, January 13, 1974, ran for six weeks with four experimental treatments each week, and was concluded on February 24, 1974. There was a total of twenty-four treatment periods during the study. The post-test was administered on February 25 and 26, 1974.

Administration of Treatment

Agility development. Various research studies have been conducted in an attempt to measure the improvement of agility. In addition, coaches speak often of "the best" drills to improve agility. Todannio conducted a study with fifth graders and found that their reactions did improve with daily participation in physical activities consisting of such exercises as bends-and-thrusts and shuttle runs.[2] Cotton and Deming found that one could move quickest laterally when weight was balanced on the feet and the knees were bent.[3] Smith and Harrison found that speed was particularly specific to the direction of the movement.[4] The Smith-Harrison study also found that mental practice

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[3]Dominick A. Toddanio, "Effects of Daily Fifteen Minute Period of Calisthentics upon Physical Fitness of Fifth Grade Boys and Girls," Research Quarterly, 37:276, May, 1966.

[3]Doyice J. Cotton and Donald Deming, "Comparison from Variation of the Upright Stance," Research Quarterly, 40:196, May, 1970.

[4]Leion E. Smith and John S. Harrison, "Comparison of Effects of Visual Motor, Mental, and Guided Practice upon Speed and Accuracy of Performance of a Simple Eye-Hand Task Coordination Task," Research Quarterly, 32:208, May, 1966.

was of essential importance in the ability to change direction accurately.[5]

Tschetter utilized a fifteen-minute treatment period. Although his study concluded that selected drills (wave drills, figure eight, forward roll, and jumping dummies) had no effect on the ability to change direction quickly, he discovered a significant improvement in dynamic balance.[6] Smith found that selected agility drills (upright wave drills, bear wave, carioca, forward and backward sprints, quarter eagle, and bench jump) did improve a subject's ability to change direction rapidly and accurately through a large range of movement.[7]

The literature, consultation, and experience appear to support the premise that most physical educators and coaches are familiar with drills that develop agility. Wiley and De Pasqua stated that: "We all use about the same agility drills and conditioning drills."[8]

On record as having stated that agility drills should be

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[5]Leion E. Smith, "Individual Differences in Strength, Reaction, Latency, Mass and Length of Limbs and Their Relation to Maximal Speed of Movement," Research Quarterly, 33:299, May 1961.

[6]Douglas Lee Tschetter, "The Effects of Selected Football Drills on Agility" (unpublished Master's thesis, South Dakota State University, 1965), p. 23.

[7]Richard Smith, "The Effects of Selected Football Drills upon the Improvement of Agility" (unpublished Master's thesis, South Dakota State University, 1969), p. 9.

[8]Jack Wiley and Carl De Pasqua, "Player Demonstration and Drills with University of Pittsburg Players," Thirty-Eighth Annual Meeting, American Football Coaches Association, January 9-11, 1961, p. 97.

scheduled daily into a workout schedule are coaches Dickie,[9] McClendon,[10] Bryant,[11] and Beall.[12] These drills vary from lateral movement to speed and to a combination of strength and endurance. Tipps stated that, at his college, if his coaches had to give up something, they would give up strength for speed and agility.[13] Eaton stated that various drills can improve football players by making them more agile in the ability to move in different directions quickly.[14] Gibson claimed that the basic agility drills are: bear wave, upright wave, three-man roll, and backward running.[15] Broyles[16] and Graves[17] stated that an individual can improve quickness and agility through ten-second

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[9]Doug Dickie, "Speed and In-Season Running," Forty-Fourth Annual Meeting, American Football Coaches Association, 1967, pp. 19-20.

[10]Charlie McClendon, "Agility Drills for Defense," Fortieth Annual Meeting, American Football Coaches Association, 1964, pp. 9-11.

[11]Paul "Bear" Bryant, Building a Championship Football Team (Englewood Cliffs, New Jersey: Prentice Hall Inc., 1960), pp. 213.

[12]Bill Beall, "Continuity in L.S.U.'s Drills for Defensive Secondary," Forty-Second Annual Meeting, American Football Coaches Association, 1965, p. 26.

[13]Tom Tipps, "Defensive Line Drill," Thirty-Eighth Annual Meeting, American Football Coaches Association, 1961, pp. 94-99.

[14]Lloyd Eaton, "Wyoming Defensive Line Drills," American Football Coaches Association Summer Manual, 1967, pp. 42-46.

[15]Vince Gibson, "Building Championship Linebackers," American Football Coaches Association Summer Manual, 1967, pp. 40-46.

[16]Frank Broyles, "A New Program in a New School," Texas Coach, 10:22, September, 1966.

[17]Ray Graves, Guide to Modern Football Defense (West Nyack, New York: Parker Publishing Co., 1966), p. 48.

or quick drills in which he remains in a small area or that teams can use these drills, combined with the pressure of time and verbal commands, to change direction quickly.

Many coaches spend time both during the season and in the off-season trying to develop agility. Coaches use basically the same nucleus of drills from which they choose the ones that will serve their purposes and needs; these include drills involving a large range of movement and running drills as is stated by Fuoss in his book on football drills.[18] One of the primary points found through research is the variety of drills and sequences used by various coaches.[19]

This investigator, through observation, reading, and consultation has found that coaches spend from five to fifteen minutes for the development and improvement of agility through an assortment of drills. Thus having established these existing practices, a pilot study was conducted prior to the onset of treatments in order to assist the establishment of a sequence and the number of repetitions applied to each experimental group.

Training routines. The daily training routine utilized in this study consisted of fifteen minutes of agility drills for each group (A, B, and C). In addition to the fifteen minutes of agility drills for

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[18]Donald E. Fuoss, Championship Football Drills for Teaching Offensive and Defensive Fundamentals and Techniques (Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1964), p. 29.

[19]Editors, Coaching Clinic, The Best of the Coaching Clinic New York: Parker, 1967), pp. 15, 217, 237.

A, B, and C, there was an activity in which all four groups participated during this study--that of weight training and distance running. For Groups A, B, and C weight training and distance running followed the agility drills. Weight training was held on Monday, Wednesday, and Thursday with the investigator controlling and administering this program as well. Weight training was guided and directed toward heavy-weight work in two principal areas: (1) bench press, and (2) squats. Some less intensified training in military press, curls, and lat machine also was conducted. Distance running consisted of a two-to-three-mile run on Tuesdays and Thursdays.

Group A. Group A participated in timed drills commonly called "ten second" or "quick drills." The review of literature, the investigator's experience, observation of coaches, plus the recommendations by Broyles,[20] McClendon,[21] Mayfield,[22] and Cameron[23] resulted in a composite list of drills for the purpose of improving agility (Table 1).

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[20]Broyles, op. cit., p. 28.

[21]McClendon, op. cit., p. 237.

[22]Gene Mayfield, "Building a Winning Program," Texas Coach, 12:22, August, 1968.

[23]James Cameron, Coaching Procedures Employed at Howard Payne College, 1968-69.

Table 1

Drills for Group A

Quick Drills (or Cal) (4 minutes) 4 Days per Week	10-Seconds (11 minutes) 4 Days per Week
1. Side-Straddle Hop	1. Jump-Reach
2. Quick-Hands	2. Push-Up
3. Tail-Gunner	3. Sit-Up
4. Quarter-Eagle	4. Rockers
	5. Mountain-Climbers
	6. Running-In-Place
	7. Squat-Thrust (burpee)
	8. Alternate-Squat-Leaps
	9. Jump-Rope
	10. Jump-A-Dummie
	11. Monkey-Right & Monkey-Left

The reason for the selection of this type treatment is based on the assumption that one can improve his ability to move quickly and accurately in changing directions of the body through a large range of movements with practice of such moves. Floor and field space are not essential in the development of improvement of agility in individuals.[24] The agenda for this group consisted of quick drills followed by ten

[24]George Allen, Encyclopedia of Football Drills (New York: Prentice Hall Inc., 1954), pp. 14-18.

second drills in the sequence indicated in Table 1. Rest periods were approximately ten seconds between each drill. The drills were administered in such a way as to vary workload on the upper body and legs. A complete description of the drills appears in Appendix A.

Group A worked in the Wrestling Room in the Intramural Gym for the six-weeks period. The program for each day of conditioning consisted of the subjects going through each drill once. On completion of the agility drills, the subjects finished their off-season schedule with weight training on Monday, Wednesday and Thursday and with distance running on Tuesday and Thursday.

Group B. The subjects in this group were administered six commonly used agility drills employed by football coaches Jones,[25] Dickie,[26] Bryant,[27] and Lombardi.[28] Table 2 shows the agility drills selected for this study.

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[25]Gomer Jones, Offensive and Defensive Line Play (Englewood Cliffs, New Jersey: Prentice Hall Inc., 1961), pp. 36-39.

[26]Dickie, op. cit., p. 23.

[27]Bryant, op. cit., pp. 209, 219.

[28]Vince Lombardi, Run to Daylight (New York: Grossett and Dunlap, 1963), p. 87.

Table 2

Drills for Group B

Drill	Time
1. Bear Walking	3 minutes
2. Three-Man Roll	3 minutes
3. Upright Wave	3 minutes
4. Bear Wave	3 minutes
5. Tumbling Wave	3 minutes

The above drills were applied at each treatment period. The subjects were subdivided into three teams of five to allow a recovery period between sets. The number of sets varied as to the performance of the drill by the subdivided teams; but the sets ranged from three to four sets of each drill. A complete description of the drills and repetitions appears in Appendix A. The treatments were administered in the Intramural Gym at South Dakota State University. The decision to use this type of agility drills was based on the investigator's definition of agility--to move quickly and accurately from a position or direction through a large range of movements.[29] The treatment lasted fifteen minutes on each of the prescribed days and was followed by the remainder of the off-season program.

[29]McCauliff, op. cit., p. 27.

Group C. Subjects in this group were administered the "speed drill" treatment. The related literature supported a commonly used method of improving or developing agility in individuals by moving rapidly from one point to another.[30] Table 3 shows the speed drills selected for this study.

Table 3

Drills for Group C

Drills (Timed Events)	Time
10-yard dashes (sprints). . . . 20-yard dashes	.5 minutes
10-yard lateral right and left.	.5 minutes
10-yard backward . . . . . . 20-yard backward	.5 minutes

The decision to administer this type of program was justified in related literature by Bryant,[31] McClendon,[32] and Dickie[33] all of whom used and recommended speed work (forward, lateral, and backward) in their respective programs. Barrow stated that agility is a collection of physical, psychological and structural factors which affect

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[30] Ibid., p. 37.

[31] Bryant, op, cit., pp. 226-227.

[32] McClendon, op, cit., pp. 9-11.

[33] Dickie, op. cit., pp. 19-22.

individuals in different ways.[34] Group C met on the balcony of the Intramural Gym, and the treatment was administered in a fifteen-minute period of time to be followed by the remainder of the off-season program (weight training and/or distance running). A time-scale and example appears in Appendix A.

Group D. This group was the control group, and the subjects' activity was the three days of weight training and two days of distance running per week. In the control group, subjects completed their assignments on their own. Subjects were pre-tested and post-tested as were the three experimental groups.

Collection of Data

Agility measurement. Numerous tests have been developed and used to measure agility. What components of agility should be measured are not well-defined. Cureton used three items to test agility: (1) kneeling-jump, (2) sprint-to-feet-and-balance-three-seconds, and (3) back-sprint-and-touch-hands-to-toes-at-least-waist-high five times in succession. He also used a six-count exercise, commonly known as the squat-thrust, six times in twenty seconds.[35] Willgoose cites the use of the dodging run, zig-zag and obstacle run to test agility.[36]

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[34]Barrow, op. cit., p. 114.

[35]Thomas K. Cureton, et. al., Physical Fitness Appraisal and Guidance (St. Louis: C. V. Mosby Co., 1967), p. 114.

[36]Carl E. Willgoose, Evaluation in Health Education and Physical Education (New York: McGraw Hill Book Co., 1961), p. 259.

McCloy and Young found that the side-step,[37] shuttle run,[38] obstacle run,[39] and the squat thrust (burpee)[40] were the four most common means by which agility had been measured over the last thirty-five years.[41] Fleishman stated that four of the most common agility tests were the side-step, squat thrust, shuttle run, and obstacle run.[42] Fleishman additionally reported that there are two basic ideas used to measure agility: (1) speed in changing direction, and (2) strength in changing direction.[43]

McCauliff searched for a test that would measure agility in all its complex factors but failed to find a satisfactory method.[44] Fleishman[45] and Cumbee[46] both agree about the complexity of skill and agility in sports. They discussed the factors related to agility

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[37]Charles Harold McCloy and Norma Dorothy Young, Tests and Measurements in Health and Physical Education (New York: Appleton-Century and Crofts, Inc., 1954), p. 75.

[38]Robert Jackson, "An Analysis of the Interrelationship of a Series of Recommended Agility Tests" (unpublished Master's thesis, University of Maryland, 1961), p. 74.

[39]Barrow, op. cit., p. 113.

[40]Ibid., p. 56.

[41]McCloy and Young, op. cit., p. 79.

[42]Edwin A. Fleishman, Examiner's Manual for the Basic Fitness Test (Englewood Cliffs, New Jersey: Prentice Hall Inc., 1964), pp. 31-32.

[43]Ibid., p. 176.

[44]McCauliff, op. cit., p. 5.

[45]Fleishman, op. cit., p. 101.

[46]Frances Z. Cumbee, "Factoral Analysis Motor Coordination," Research Quarterly, 25:414-428, December, 1954.

and the relationship between factors like speed, strength, endurance, power and coordination to be able to change directions.

There are agility tests that highly correlate with sports ability. McCauliff,[47] Cozens,[48] Barrow,[49] and McCloy[50] were able to measure a relationship between agility and sports skills. McCauliff's test has seven components: (1) change of levels, (2) lateral shuffle, (3) lateral leap, (4) rotational pattern, (5) forward diagonal pattern, (6) change of direction run, and (7) forward stride break.[51] These factors also were cited by: McCloy,[52] Barrow,[53] Jackson,[54] McClendon,[55] and Hilssendager, Strow, and Ackerman.[56] McCauliff sought to combine components to measure agility in a comprehensive and objective form.[57] Tests prior to McCauliff's had measured such aspects as speed, strength,

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[47]McCauliff, op. cit., p. 5.

[48]Fleishman, op. cit., p. 259.

[49]Barrow, op. cit., p. 83.

[50]McCloy and Young, op. cit., p. 11.

[51]McCauliff, op. cit., pp. 37-38.

[52]McCloy and Young, op. cit., p. 2.

[53]Ibid., pp. 18-38.

[54]Barrow, op. cit., p. 91.

[55]Jackson, op. cit., p. 74.

[56]Donald R. Hilssendager, Malcolm H. Strow, and Kenneth J. Ackerman, "Comparison of Speed, Strength, and Agility Exercises in the Development of Agility," Research Quarterly, 40:79, March, 1969.

[57]McCauliff, op. cit., p. 2.

flexibility, reaction, coordination, and endurance separately and in differently associated groups but never as compactly as this test.[58]

McCauliff's aim was to develop a test that would evaluate the individual's capacity for the development of motor activities.[59] She hoped to develop a highly valid method by which educators and coaches could evaluate more completely the agility of students and/or athletes. To validate this study, the following criteria were established:

1. Demonstration of a high degree of reliability.

2. Ability to discriminate among groups representing various levels of proficiency and/or participation in selected group or varsity sports and the total college physical education program.

3. Demonstration of impartiality in the measurement of the capacities for agile movement of subjects varying in height and weight.[60]

There is no truly objective method to measure agility during competitive circumstances, but McCauliff's test does allow researchers to measure all of those components associated with agility in a compact and accessible method.[61] McCauliff used the subject's fastest time in computing the score data which were used to validate the agility component test. Her subjects were seventy-nine in number, and all were put through two four-trial testing sessions within a span of no less than two days nor more than four days apart. One week following the

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[58] Ibid., p. 2.

[59] Ibid., p. 2.

[60] Ibid., p. 29.

[61] Ibid., p. 32.

second four-trial session, a single running of the test was used to compute a reliable coefficient of correlation. The reliability coefficient ranged from .87 (basketball) to .99 (major low skills index) for the six groups. The combined total sample reliability coefficient was .99.[62] As a result of searching the literature, the McCauliff's Agility Component Test was adopted for this study. McCauliff developed two forms for testing agility, and for this study the long form was adopted. This procedure involved the total time it took for a subject to complete the seven components of the test.[63] The short form, being the time it takes to complete each of the seven components, was not used due to lack of stop watches and adequate assistants to administer this test.

The fastest time of each subject was used in computation. Data were recorded in seconds to the nearest tenth. As recommended by McCauliff, each individual was instructed about the test prior to its administration and had the opportunity to run through the test twice prior to the recording of test times. The pre-test consisted of four attempts with the best time being used for data purposes.[64] Subjects were advised how to start and finish the test, that failure to negotiate a component would result in the command "no," and that correct completion

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[62] Ibid., p. 19.

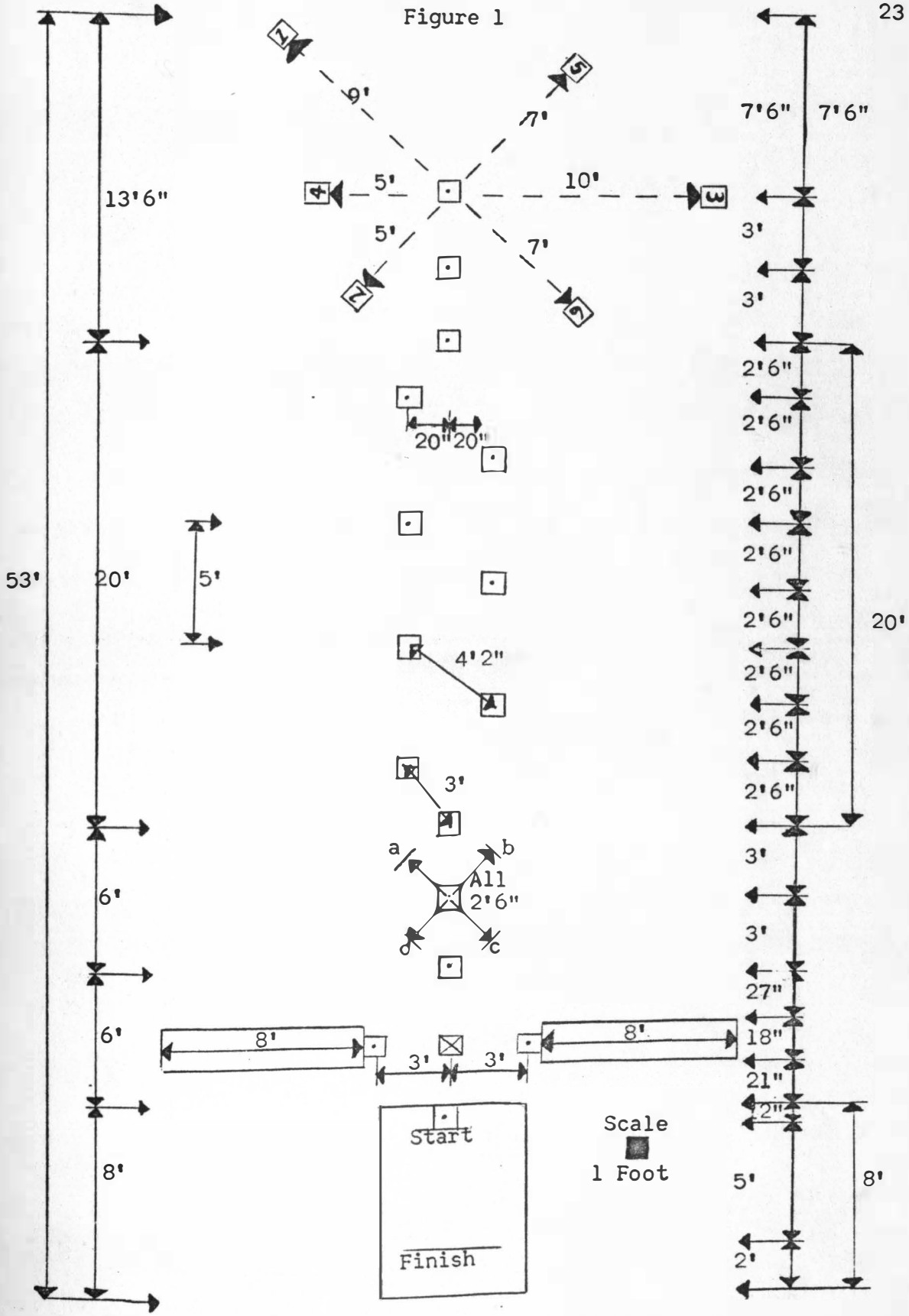
[63] Ibid., p. 23.

[64] Ibid., p. 40.

of the component must occur before continuing the course.[65] A diagram of the test appears in Figure 1, page 23. The identical testing procedures recommended by McCauliff were employed for the post-test.

[65] Ibid., p. 56.

Figure 1



McCAULIFF AGILITY COMPONENTS TEST

CHAPTER III

ANALYSIS AND DISCUSSION OF RESULTS

Chapter III

ANALYSIS AND DISCUSSION OF RESULTS

Organization of the Data for Treatment

The data were organized in a manner that permitted an analysis of the changes that occurred between each group's means on the two successive tests. The subjects were divided into four groups and an F ratio was computed to determine the significance of the differences among the groups' mean changes. The changes in the group's agility, as measured by the McCauliff Agility Components Test, were used as the criteria for the analysis of the data recorded between Test I (pre-test) and Test II (post-test). The computation procedure followed to determine the F ratio was a Completely Randomized Analysis of Variance Design.[1] The .05 level was selected as the minimum level of confidence for the acceptance of a significant difference. Raw scores for each of the tests appear in Appendix C.

Analysis and Discussion of Results

The subject's fastest time on each of the two tests was used to compute the group means for the respective tests. The means and standard deviations of the groups are shown in Table 4.

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[1]James L. Bruning and B. L. Kintz, Computational Handbook of Statistics (Glenview, Illinois: Scott, Foresman and Company, 1968), pp. 22-25.

Table 4

Mean and Standard Deviation of Group Performances for Test I and Test II

Group	Test I		Test II		Mean Change
	Mean	S.D.	Mean	S.D.	
A	23.57	2.88	21.39	1.04	2.18
B	23.63	2.46	21.54	.88	2.09
C	23.02	2.04	21.09	1.53	1.94
D	23.58	2.31	22.91	1.94	.67

The results of the analysis of variance for the changes among group means obtained from Test I and Test II are found in Table 5. The F ratio of 2.47 indicated there was no significant difference among the groups at the .05 level of confidence; therefore, the null hypothesis was retained.

Table 5

Analysis of Variance of the Change in Group Means between Test I and Test II

Source of Variance	Sum of Squares	Degree of Freedom	Mean Squares	F*
Total	181.57	54	--	--
Between groups	20.92	3	6.97	2.47
Within groups	143.71	51	2.83	--

*$F_{.05}$ (3/51)= 2.80.

The F ratio of 2.47 approached the .05 level and did exceed the .10 level. The three treatment groups did show mean changes of about the same magnitude (2.18, 2.09, 1.94) and were about triple the control group's change (.67).

In the author's opinion, agility can be improved slightly with the use of non-contact agility drills even though the .05 level of confidence was not reached. The conclusion is based on three points.

(1) The F ratio was very close to the .05 level of confidence; since surpassing the .10 level of confidence, it warrants consideration.

(2) Small differences may be very meaningful in a football game as is true in all sports. Mitchell illustrates the importance of small differences in times in a 100-yard dash where one athlete wins in 9.6 seconds and the fifth-place finisher is clocked in 9.7 seconds.[2] There are three people within one tenth of a second and between winning and fifth place. Allen states that the time difference between football players can be the difference between winning and losing.[3]

(3) Coaches and some researchers suggest that the quality of agility is improvable through work. Coaches Bryant,[4] Lombardi,[5]

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[2]Pat Mitchell, "What Is a Sprinter?," Texas Coach, 17:30, May, 1974.

[3]George Allen, Encyclopedia of Football Drills (New York: Prentice Hall Inc., 1954), p. 16.

[4]Paul "Bear" Bryant, Building a Championship Football Team (Englewood Cliffs, New Jersey: Prentice Hall Inc., 1960), pp. 209, 226-227.

[5]Vince Lombardi, Run to Daylight (New York: Grossett and Dunlap, 1963), p. 87.

and Cameron[6] all used and recommended agility drills to improve the agility of their athletes. Hilssendager, Strow and Ackerman found in their study of male college students that agility can be improved; and it best can be improved through the administration of drills and exercises designed especially for the development of agility.[7] Smith found that agility could be improved through selected agility drills at the .05 level of confidence in his study which employed freshman physical education students.[8] Tschetter found in his study of college athletes that agility could not be improved significantly through selected agility drills at the .01 level of confidence; but his findings did reach the .05 level of confidence.[9] On the other hand, Beise and Peasely found that agility could not be significantly improved in college students. However, they used tennis, golf, and archery as activities to improve agility.[10]

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[6]James Cameron, Techniques of Coaching Football Theory Class, Howard Payne College, Brownwood, Texas, 1968-69.

[7]Donald R. Hilssendager, Malcolm H. Strow, and Kenneth J. Ackerman, "Comparison of Speed, Strength and Agility Exercises in the Development of Agility," Research Quarterly, 40:71-75, March, 1969.

[8]Richard Smith, "The Effects of Selected Football Drills upon the Improvement of Agility" (unpublished Master's thesis, South Dakota State University, 1969), p. 9.

[9]Douglas Lee Tschetter, "The Effects of Selected Football Drills upon Agility" (unpublished Master's thesis, South Dakota State University, 1965), p. 23.

[10]Dorothy Beise and Virginia Peaseley, "The Relation of Reaction Time, Speed, and Agility of the Big Muscle Groups to Certain Sports Skills," Research Quarterly, 40:76-80, March, 1969.

After observing the performance of the subjects used in this study and after considering the above three points, the investigator feels that agility can be increased slightly. Although not all facts support that agility can be improved significantly through selected drills, evidence would show a trend to support this investigator's contention that agility can be improved through selected agility drills.

Since there was no significant difference between the three treatment groups and since the group mean changes were of about the same magnitude (2.18, 2.09, 1.94), the investigator would not recommend one program over another. The coach should select the drills which he feels appropriate for his particular situation.

CHAPTER IV

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

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SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary of Study

The purpose of this study was to compare the effects of different selected non-contact drills upon the improvement of agility as measured by the McCauliff Agility Components Test.[1]

Subjects incorporated in this study were 55 volunteers from the SDSU varsity football team. All had competed on intercollegiate teams. All subjects were full-time students at SDSU. The subjects were divided into four groups designated A, B, C, and D. Each group was assigned randomly an experimental treatment.

Through reading, association, and experience with men of the coaching profession, the investigator selected drills which were believed would contribute to the development of agility. Pilot studies were conducted prior to the onset of experimental treatment to determine the time sequences as well as the number of repetitions used in each drill set. The experimental groups (A, B, C) participated in a six-weeks training program during which they met four times weekly. Each treatment lasted fifteen minutes, and the sequential arrangement of drills remained constant the entire period of the study. The drill sequences were designated: Group A--quick drills such as side-straddle

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[1]C. Elizabeth McCauliff, "A Test of Selected Agility Components" (unpublished Doctor's dissertation, Springfield College, Springfield, Massachusetts, 1968), pp. 1-97.

hop, quick-hands, tail-gunner, and quarter-eagle and 10-second drills such as jump-and-reach, push-ups, sit-ups, rockers, mountain-climbers, running-in-place, squat-thrust, alternate-squat-leap, jump-rope, jump-dummy, and monkey-right and monkey-left; Group B--wave drills such as bear-walking, bear-wave, three-man-roll, upright-wave, tumbling-wave; Group C--speed drills such as 10-yard forward and backward sprints, 10-yard sprints lateral right and left, 20-yard sprints forward and backward; Group D served as the control group. In addition to the drills administered to the three treatment groups, all four groups took part in weight lifting on Monday, Wednesday, and Thursday and distance running on Tuesday and Thursday.

The McCauliff Agility Components Test was administered on two scheduled occasions. Times for the test were recorded to the nearest tenth of a second, and each subject's fastest time for each of the two tests was used in computing group means for the respective test. Test I was administered on January 9 and 10, 1974 prior to the onset of the experimental treatments. Two orientation runs and four time trials were administered, and the subject's fastest time was used to compute the group means. Test II was administered February 25 and 26, 1974 after six weeks of treatment. No orientation run was used; subjects ran the test four times, and their fastest time was used to compute group means.

The statistical technique used to treat the data was analysis of variance. Analysis of variance was computed to test for the significance of the differences among each group's mean changes between

Test I and Test II. The F ratio was found not to be significant at the .05 level of confidence; however, it exceeded the .10 level and approached the .05 level. Although the investigator accepted the null hypothesis, he did feel agility drills can assist in the development of agility due to (1) the F ratio approached the .05 level of confidence, (2) sometimes small differences may be valuable, and (3) some research, coaches, and experiences support this contention.

Conclusion and Implication

Within the limitations described in this study, the following conclusions appear warranted.

1. Agility did not improve significantly at the .05 level of confidence through the selected training programs designed with the purpose of improving agility.

2. Since the F ratio exceeded the .10 level of confidence and since the trend in related research and coaches' statements support the use of agility drills in workouts during season and in off-season training programs, the use of agility drills to improve agility is beneficial.

Recommendation for Further Study

Based on the finding of this study, the investigator proposes the following recommendations for further study.

1. That studies be conducted to measure the effect of various types of conditioning on the performance of the McCauliff Agility Components Test.

2. That a similar study be conducted allowing for the administration of a retention test succeeding a deconditioning program.

3. That similar studies be conducted varying the length and number of treatments incorporated within the training program.

4. That similar study be conducted utilizing an additional group which would consist of a continuous variety of the three experimental treatments.

5. That a similar study be conducted using three days instead of four per week of treatment.

6. That a similar study be conducted and a relationship be run between Grade Point Average to the performance of the McCauliff Agility Components Test.

7. That a similar study be conducted and a motivation test be used to compare the performance with the motivation level of the subjects.

8. That a study be conducted on fifth-grade students and correlated to this or another study involving college students or college athletes.

9. That a similar study be conducted eliminating the weight training and distance running.

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APPENDICES

APPENDIX A

Group A Procedure and Commands

The treatment for Group A began with the subjects in this group ready to begin work at 3:30 P. M. promptly. Prior to the starting time, the participants loosened up and stretched out on their own. The program was designed to emphasize mental concentration, explosiveness, and quickness with competition being against time, self, and others. A continuous progression in number of repetitions executed in this treatment group is shown in Table 6.

Formation. The group formed three lines with five subjects per line and one man out front facing the others to lead the drills. This leader was alternated daily.

Ready position. This position is one common to all sports--knees bent slightly, weight evenly distributed on both feet, back straight, head up and hands at hips flexed ready to respond to any command.

Commands. The investigator gave all commands during the period. To execute quick drills, an alert and confident sense of mind was needed. Either voice or whistle can be used to have subjects execute the drills. In the opinion of this investigator, the voice seemed to work best and was used.

The preparatory command to begin all drills was "READY, BREAK

DOWN" which indicated to the subjects that they were to assume the ready position.

After the preparatory command had been given, the subjects responded one movement for each "HUT" they heard. Each drill was executed only once during a treatment period with several repetitions of each particular drill ranging from 5 to 17 in number.

At the completion of each drill, the investigator halted subjects with "ALRIGHT" and allowed the participants to relax their position for no more than ten seconds. At this time, clapping and yelling was desired and recommended.

Treatment. The treatment for Group A was in two parts: Quick Drills and 10-Second Drills. The first portion consisted of four "quick drills." The drills were begun slowly with commands being accelerated as the subjects learned and developed throughout the course of the study.

Quick Drills

Drill #1--Side-Straddle-Hop: Regularly done, this is a two-count exercise. All movements are quick and short--emphasizing explosive movement.

"READY, BREAK DOWN"--Subjects assumed ready position
"HUT"--Subjects brought hands from hips to touch forehead and brought feet together
"HUT"--Subjects returned to ready position
"ALRIGHT"--(after desired number of repetitions) Subjects yelled and clapped (refer to Table 6)

Drill #2--Quick-Hands: The same procedure was followed as in the first drill with subjects increasing number of "HUTS" and movements they were able to comprehend and execute at a particular time. Emphasis, again, was on explosive quick action by the subjects.

"READY, BREAK DOWN"--Subjects assumed ready position
"HUT"--Subjects touched right hand to left thigh and returned to ready position immediately
"HUT"--Subjects touched left hand to right thigh and returned to ready position immediately
"ALRIGHT"--(after desired number of repetitions) Subjects yelled and clapped (refer to Table 6)

Drill #3--Tail-Gunner: Again, subjects increased their rapidness of execution in this five-count exercise.

"READY, BREAK DOWN"--Subjects assumed ready position
"HUT"--Subjects slapped thigh
"HUT"--Subjects slapped chest
"HUT"--Subjects slapped forehead
"HUT"--Subjects slapped chest
"HUT"--Subjects slapped thigh
"ALRIGHT"--(after desired number of repetitions) Subjects yelled and clapped (refer to Table 6)

The hand always stayed in the position of last "HUT" and touch until another "HUT" was heard.

Drill #4--Quarter-Eagle:

"READY, BREAK DOWN"--Subjects assumed ready position
"HUT"--Subjects turned quarter turn by jumping and turning body while in air
"HUT"--Subjects turned quarter turn
"HUT"--Subjects turned quarter turn
"HUT"--Subjects turned quarter turn
"ALRIGHT"--(after desired number of repetitions) Subjects yelled and clapped (refer to Table 6)

To execute this drill, the subjects started to the right for 5 to 10 repetitions then stopped and went to the left for 5 to 10 repetitions. One repetition was one complete revoltution, 360 degrees.

10-Second Drills

Immediately, the second phase of the treatment--the 10-second drills--was begun. Between each drill, there was no more than a 10-second recovery period. A stop watch was used for this entire treatment.

Drill #1--Jump-and-Reach:

"READY, BREAK DOWN"--Subjects assumed ready position
"BEGIN"--The subjects began to jump and try and touch the ceiling with their hands (emphasis was on explosive springing in the jump and the number of repetitions one could do during 10 seconds). Each subject kept his record, and the investigator took a verbal census daily. This drill ended at the end of 10 seconds.
"ALRIGHT"--Subjects moved into position for next drill. (refer to Table 7)

Drill #2--Push-Ups:

"READY, BREAK DOWN"--Subjects assumed ready position
"BEGIN"--Subjects started to execute as many correct push-ups as possible in 10 seconds (explosiveness was emphasized)
"ALRIGHT"--Subjects returned to ready position (refer to Table 7)

Drill #3--Sit-Ups (bent knees):

"READY, BREAK DOWN"--Subjects assumed ready position
"SIT-UP POSITION"--Subjects started from supine, hands behind head, bent knees, and feet flat on floor
"READY BEGIN"--Subjects executed sit-ups and strived for the maximum possible to execute in 10 seconds
"ALRIGHT"--Subjects returned to ready position (refer to Table 7)

Drill #4--Rockers:

"READY, BREAK DOWN"--Subjects assumed ready position
"ROCKER POSITION"--Subjects lay on the abdomen, hands behind head or behind back, lifted legs to sky and leaned head back to sky
"READY BEGIN"--Subjects rocked back and forth and counted each time the chin touched the floor as one repetiton
"ALRIGHT"--Subjects returned to ready position (refer to Table 7)

Drill #5--Mountain-Climbers:

"READY, BREAK DOWN"--Subjects assumed ready position
"MOUNTAIN CLIMBER POSITION"--Subjects got down on all-fours with right foot drawn up under chest and left leg dropped back as a man in a starting block in track
"BEGIN"--Subjects looked straight ahead and rotated this position by dropping the right leg back and drawing the left leg up under the chest. A repetition was completed each time the right leg returned to the starting position under the chest--making sure the foot set down on the deck as leg was drawn forward
"ALRIGHT"--Subjects moved to next position (refer to Table 7)

Drill #6--Running-in-Place:

"READY, BREAK DOWN"--Subjects assumed ready position
"BEGIN"--Subjects ran in place (up on toes) as fast as possible, pumped their arms rapidly (this improved running form as well as coordination), and counted each time the right foot touched the floor
"ALRIGHT"--Subjects went to next drill (refer to Table 7)

Drill #7--Squat-Thrust (burpee):

"READY, BREAK DOWN"--Subjects assumed ready position
"SQUAT THRUST POSITION"--Subjects assumed position with slightly bent knees and weight on balls of feet
"BEGIN"--Subjects dropped hands to floor and at same time extended feet to rear, dipped hips, pulled legs and feet up to themselves and stood--one repetition
"ALRIGHT"--Subjects returned to ready position (refer to Table 7)

Drill #8--Alternating-Squat-and-Leaps:

"READY, BREAK DOWN"--Subjects assumed ready position
"SQUAT AND LEAP POSITION"--Subjects squatted slightly on knees, dropped one leg to rear, hands behind head, and eyes looked straight ahead
"BEGIN"--Subjects leaped and exchanged position of right and left leg--completing one repetition each time the right or left leg returned to starting position (as the program progressed, the knee was placed farther to the rear: thus lengthening and strengthening both hamstring and thigh muscles)
"ALRIGHT"--Subjects returned to ready position (refer to Table 7)

Drill #9--Jump-the-Rope:

"READY, BREAK DOWN"--Subjects assumed ready position
"ASSUME JUMP ROPE POSITION"--Subjects held rope dangling on floor behind feet, knees were slightly flexed
"BEGIN"--Subjects tried to jump as fast as possible everytime the rope hit the deck or one revolution was one repetition (emphasis was on keeping feet close to floor and speed)
"ALRIGHT"--Subjects returned to ready position (refer to Table 7)

Drill #10--Jump-A-Dummy:

"READY, BREAK DOWN"--Subjects assumed ready position beside blocking dummy
"BEGIN"--Subjects jumped over and back in one motion for one repetition and attempted to jump as fast and stay as low as possible
"ALRIGHT"--Subjects returned to ready position (refer to Table 7)

Drill #11--Monkey-Right-and-Monkey-Left:

"READY, BREAK DOWN"--Subjects assumed ready position
"ASSUME MONKEY POSITION"--Subjects put right hand on floor and extended themselves so as to have a stiff arm and right leg to form a 90 degree angle
"BEGIN"--Subjects ran around their right hands as fast as possible with each revolution being one repetition; they pumped with free arm rapidly. At the end of 10 seconds the investigator stopped them, and the subjects reversed position to go to the left
"ALRIGHT"--Subjects returned to ready position (refer to Table 7)

When this drill was over, subjects were sent to the remainder of their off-season program according to the daily schedule.

Table 6

Number of Repetitions for Each Drill per Week Executed by Group A

Quick Cal Drills	1 wk.	2 wks.	3 wks.	4 wks.	5 wks.	6 wks.
1. Side-Straddle-Hop	5	7	9	11	13	15
2. Quick-Hands	7	9	11	13	15	17
3. Tail-Gunner	7	9	11	13	15	17
4. Quarter-Eagle						
Right	5	7	9	11	13	15
Left	5	7	9	11	13	15

Table 7

Number of Repetitions for Each Drill per Week Executed by Group A

10-Second Drills	1 wk.	2 wks.	3 wks.	4 wks.	5 wks.	6 wks.
1. Jump-and-Reach	6-12	8-14	10-15	12-16	14-18	16-20
2. Push-Ups	8-12	10-14	12-14	14-18	16-20	18-22
3. Sit-Ups	8-12	10-14	12-16	12-16	14-18	16-24
4. Rockers	6- 8	8-10	10-12	12-16	14-18	16-20
5. Mountain-Climbers	8-10	10-12	12-14	14-16	16-18	18-22
6. Running-In-Place	18-20	20-24	24-28	28-32	30-34	32-36
7. Squat-Thrust	6- 8	8-10	10-12	12-14	14-16	14-18
8. Alternating-Squat-and-Leaps	6- 8	8-10	10-12	12-14	14-16	16-18
9. Jump-the-Rope	25 avg.	30 avg.	35 avg.	40 avg.	45 avg.	50 avg.
10. Jump-A-Dummy	12-15	14-18	16-20	20-24	24-30	30-34
11. Monkey-Right-and-Monkey-Left	6- 8	8-10	10-12	12-14	14-16	16-18

Group B Procedure and Commands

The subjects were responsible for loosening up and stretching out on their own prior to work out. Workout started at 3:45 promptly. The program was designated to emphasize quickness, explosiveness, and stamina. The subjects were broken down into three lines of even numbers. To begin all drills, the subjects were in a basic three-point or four-point stance; the starting command was "SET GO" and the command to stop was "ALRIGHT." The investigator used an extra set of each drill in the second and fourth week to challenge the subjects.

Drill #1--Bear-Walking: This drill was conducted by subjects assuming a four-point stance (hands and feet on floor) and sprinting forward on the command "SET GO" 15 yards and back past the starting line (emphasis on keeping weight on hands and arms). This drill was repeated until all subjects had the required sets of the drill. The rest period between sets was approximately 10 seconds. (refer to Table 8)

Drill #2--Three-Man-Roll: This drill was conducted with three subjects jumping over and rolling under each other in a figure eight pattern. Example: Subject B rolled left or right under A or C who in turn rolled under the remaining individual. This drill was conducted for 5 repetitions as an average number in each set. One repetition was executed when the man in the middle who started the drill returned to the center of the formation. To stop the drill, the command "ALRIGHT" was given and the subjects recovered balance and sprinted past the

investigator as fast as possible without standing first and then running. (refer to Table 8)

Drill #3--Upright Wave: This next drill was conducted by the subjects starting from a three-point stance, sprinting approximately five-yards, and then breaking laterally right or left depending upon which way the investigator indicated for them to go with his hand signal. The subjects ran as hard as possible; and when a signal to change directions was given, they planted their outside foot solidly, stopped and drove off it in the opposite direction as fast as possible. This drill was conducted on the average of five repetitions for a set. One repetition was when a person moved laterally left and then right and returned to the center where he started. Once the subjects had completed the drill, the command "ALRIGHT" was given and the subjects sprinted past the investigator. There was approximately a 30-second rest between sets. (refer to Table 8)

Drill #4--Bear-Wave: This fourth drill was conducted from a four-point stance. On the command "SET GO," subjects sprinted forward on all-fours approximately five yards; and, on the direction signal from the investigator, went laterally left or right. Weight was concentrated on arms and head was up and looking at the investigator. The subjects had their legs driving up and down rapidly so that when a signal was given they could move to the right or left as fast as possible. The subjects completed the same number of repetitions as they did in the upright-wave drill and the same number of sets. On the command "ALRIGHT" the subjects sprinted past the investigator. (refer

to Table 8)

Drill #5--Tumbling Wave: To conduct this drill, the subjects started from the same three-point stance as in other drills. Sprinting out five yards, doing two forward rolls (emphasis on catching knees so as to have proper form as they came up on their feet), subjects were given a directional signal, moved left or right, and sprinted past the investigator. The signal was the same as in the other wave drills. (refer to Table 8)

Upon completion of these drills, this group moved on and completed the remainder of their program according to the schedule.

Table 8

Number of Sets for Each Drill per Week Executed by Group B

Drills	1 wk.	2 wks.	3 wks.	4 wks.	5 wks.	6 wks.
1. Bear-Walking	3	4	3	4	3	3
2. Three-Man-Roll	3	4	3	4	3	3
3. Upright-Wave	3	4	3	4	3	3
4. Bear-Wave	3	4	3	4	3	3
5. Tumbling-Wave	3	4	3	4	3	3

Group C Procedure and Commands

To begin with, the subjects were to loosen up and stretch out on their own prior to 4:00 when Group C's treatment was promptly begun. The program was designed to emphasize speed and explosiveness. The starting position was that of a sprinter in track or three-point football position. The starting command was "SET GO." Four sets were used in the first, third, fifth, and sixth weeks. Six sets were used in the second and fourth week to challenge the subjects. The subjects were driven by individual improvement, competition with both the watch and the other subjects as well.

Drill #1: The first drill was to sprint 10-yards forward past the investigator who timed subjects with a stop watch. The group was divided equally in lines of three; and as they finished and received their time, they jogged back as the next group ran. Only the time of the fastest individual was given. The resting time between runs was approximately 30 seconds. A set was considered executed when a subject ran through and by the investigator. (refer to Table 9)

Drill #2: The second drill was lateral 10-yard sprints both left and right. In the lateral drill the only difference was that the subjects faced left or right and assumed their regular starting position on the command "SET GO." They moved laterally and did two sets with a cross over step on the initial step and two sets with open step on initial step. Emphasis was to keep head and shoulders square--facing left or right rather than turning body to run. No cariago was

used in this drill. (refer to Table 9)

Drill #3: The last drill was 10-yard and 20-yard backward sprints. The subjects assumed a stagger two-point stance with knees slightly bent and weight balanced on ball of foot. The subjects were facing away from the investigator. The same starting count was used. The same rest period ratio was followed on these drills as in the others. (refer to Table 9)

When this program had been concluded the subjects finished the remainder of the training program.

Table 9

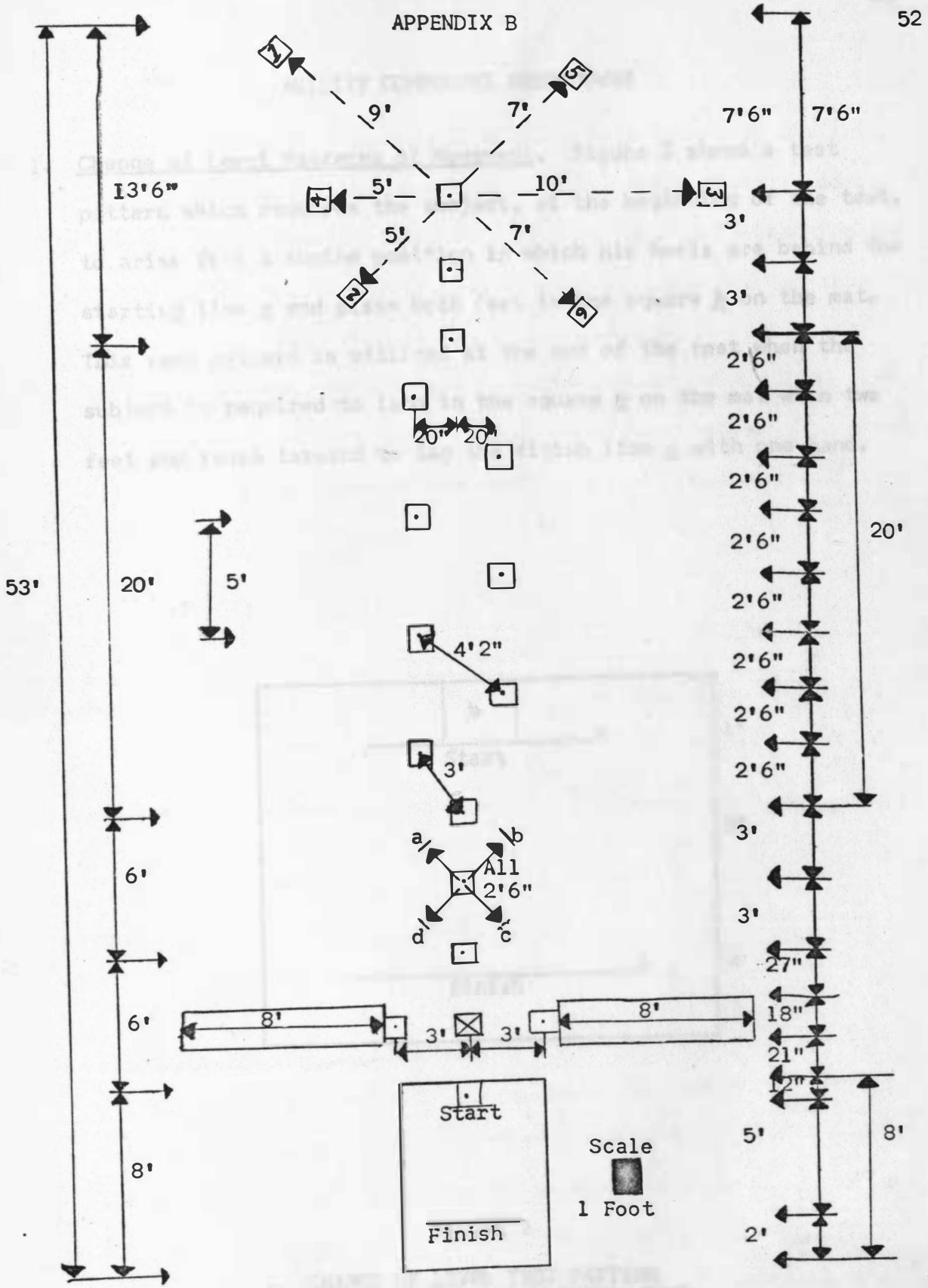
Number of Sets per Week of Each Drill Executed by Group C

Sprints	1 wk.	2 wks.	3 wks.	4 wks.	5 wks.	6 wks.
10-yd. forward	4	6	4	6	4	4
20-yd. forward	4	6	4	6	4	4
10-yd. lateral right	4	6	4	6	4	4
10-yd. lateral left	4	6	4	6	4	4
10-yd. backward	4	6	4	6	4	4
20-yd. backward	4	6	4	6	4	4

Table 10

Time Break Down of Drills per Week by Group C

Sprints	1 wk.	2 wks.	3 wks.	4 wks.	5 wks.	6 wks.
10-yard forward	1.0-1.9	1.2-1.9	1.1-1.5	1.2-1.7	1.0-1.5	0.9-1.3
20-yard forward	2.2-3.0	2.3-3.2	2.2-2.8	2.2-2.8	2.0-2.7	2.0-2.5
10-yard lateral right	1.2-1.9	1.2-1.9	1.1-1.7	1.2-1.7	1.0-1.5	0.9-1.3
10-yard lateral left	1.2-1.9	1.2-1.9	1.1-1.7	1.2-1.7	1.0-1.5	0.9-1.3
10-yard backward	1.4-1.9	1.4-1.9	1.2-1.7	1.0-1.6	1.0-1.5	0.9-1.4
20-yard backward	2.5-3.3	2.5-3.5	2.4-3.2	2.5-3.3	2.2-3.0	2.0-2.7



McCAULIFF AGILITY COMPONENTS TEST

AGILITY COMPONENT BREAKDOWNS

1. Change of Level Patterns of Movement. Figure 2 shows a test pattern which requires the subject, at the beginning of the test, to arise from a supine position in which his heels are behind the starting line a and place both feet in the square b on the mat. This same pattern is utilized at the end of the test when the subject is required to land in the square b on the mat with two feet and reach forward to tag the finish line c with one hand.

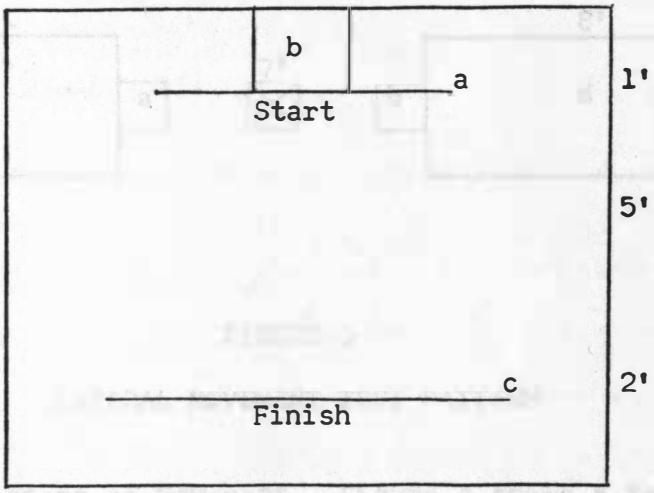


FIGURE 2

CHANGE OF LEVEL TEST PATTERN

2. Lateral Pattern of Movement. Figure 3 shows a test pattern which requires the subject to leap from the center square to the left or right to land in square a or b with two feet, shuffle laterally through the rectangle c or d by side-stepping, tag beyond the end line with one foot, shuffle back to land in the connected square a or b with two feet, leap laterally to the center square, leap laterally to the next square a or b and tag beyond the line with one foot, shuffle back to land in the connected square a or b and leap laterally, landing in the center square with two feet.

FIGURE 3

LATERAL MOVEMENT TEST PATTERN

3. Rotational Pattern of Movement. Figure 4 shows a test pattern which requires the subject to complete a four-point forward or reverse pivot after landing in the center square with two feet. Either the left or right foot may be kept stationary. Assuming the left foot remains stationary, the subject would tag line b with his right foot to begin the forward pivot (line c for the

reverse pivot), return to tag the center square, tag line a (line d for reverse pivot), return to tag the center square, and so forth in the direction of the pivot to be completed (line d, then c for forward pivot; line a, then b for reverse pivot), until the four-point pivot is completed.

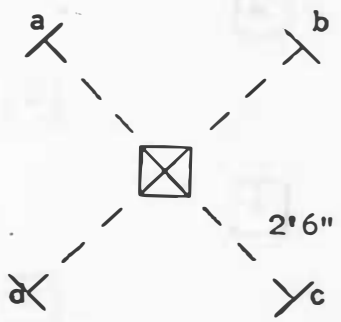


FIGURE 4

ROTATIONAL MOVEMENT TEST PATTERN

4. Forward Diagonal Pattern of Movement. Figure 5 shows a test pattern which requires the subject to land in the first square with two feet and run forward through an ordered series of squares, a, b, c, d, e, f which are placed alternately to the right and left. Each square must be touched by both feet at the same time, but both feet need not necessarily enter the squares simultaneously.

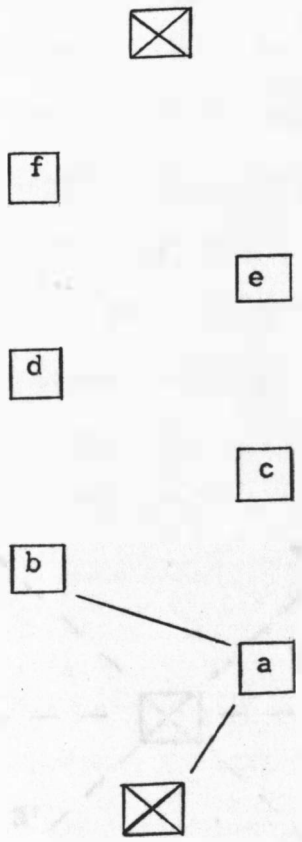


FIGURE 5

FORWARD DIAGONAL MOVEMENT TEST PATTERN

5. Change of Direction Patterns of Movement. Figure 6 shows a test pattern which requires the subject to start in the center square with two feet and run and tag each of the numbered squares with one foot. Numbered squares must be tagged in numerical order,

with the subject returning to the center square with two feet after each tag. In the running of this pattern, the subject is required to make six different angular changes of direction to the right and left.

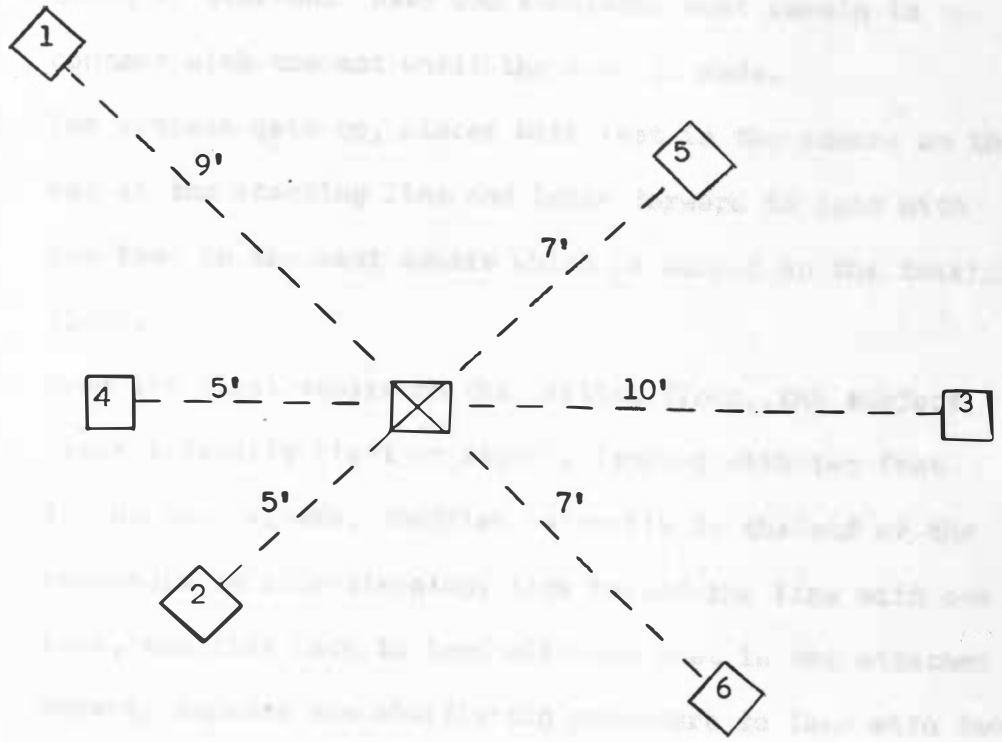


FIGURE 6

CHANGE OF DIRECTION TEST PATTERN

Performance Procedure for Agility Test

The specific procedure for performing the agility component test was as follows:

1. The subject lies in a supine position, heels behind the starting line; one arm at his side and the other bent at the elbow so that the forearm is perpendicular to the mat. At the signal, "I am ready when you are," from the timer, the subject slaps the mat with his hand and the watch is started. Head and shoulders must remain in contact with the mat until the slap is made.
2. The subject gets up, places both feet in the square on the mat at the starting line and leaps forward to land with two feet in the next square which is marked on the testing floor.
3. From the first square on the testing floor, the subject leaps laterally (left or right), landing with two feet in the next square, shuffles laterally to the end of the rectangle by side-stepping, tags beyond the line with one foot, shuffles back to land with two feet in the attached square, repeats the shuffle-tag procedure to land with two feet in the attached square and returns to the center square with two feet by means of a lateral leap.
4. The subject leaps forward, landing with two feet in the next square, then leaps forward a second time to land with two feet in the center square of the forward pivot test

pattern. Stepping diagonally forward with either foot, he tags the line, returns foot to center, tags second line with the same foot by pivoting forward a quarter-turn, returns, tags third line, returns, tags fourth line, returns and leaps forward, landing with two feet in the next square.

5. The next seven squares are traversed by forward diagonal leaps, alternating right and left. Each square must be touched by both feet at the same time, but both feet need not necessarily enter the square simultaneously.
6. The subject forward leaps to land in the next square with two feet. He then forward leaps again, landing with two feet in the center square of the change of direction test pattern.
7. From this point the subject runs to square number one, tags it with one foot, returns to tag the center square with two feet, runs to square two, tags it with one foot, returns to the center square with two feet, and continues in this manner until all six squares have been tagged in numerical order and the subject has returned to the center square with two feet and his body positioned to repeat the forward diagonal test pattern.
8. The subject leaps forward, landing in the next square with two feet. He then leaps forward to land in the next square with two feet, repeats the seven forward diagonal leaps

and forward leaps once, landing with two feet in the center square of the reverse pivot test pattern.

9. The subject steps diagonally backward with either foot, returns foot to center, tags the second line with the same foot by pivoting to the rear a quarter-turn, returns, tags third line, returns, tags fourth line and returns his foot to the center square.

10. The subject leaps forward to land in the next square with two feet. He then leaps forward a second time to land in the next square with two feet. A third forward leap places the subject with two feet in the square marked on the mat. From this position he reaches forward or leaps to a squat, all-fours or prone position to tag to finish line with one hand and stop the watch.

Note: The material in Appendix B has been reproduced from the doctoral dissertation of C. Elizabeth McCauliff entitled "A Test of Selected Agility Components," pages 28-38.

APPENDIX C

Table 11. Group A Test Results, Best Times, and Change.

Subject	Test I				Test II				Best Time		Change
	1	2	3	4	1	2	3	4	Pre	Post	
1. S. P.	19.9	20.7	20.8	21.2	22.2	20.2	20.3	20.2	19.9	20.2	-0.3
2. H. N.	22.1	21.4	21.7	21.0	23.3	21.5	21.2	20.7	21.0	20.7	0.3
3. B. M.	25.6	23.0	22.3	21.0	22.2	21.1	20.5	20.0	21.3	20.0	1.3
4. G. T.	23.5	24.5	22.3	22.0	24.6	22.0	22.7	21.3	22.0	21.3	.7
5. L. O.	28.5	24.9	22.0	22.0	23.4	21.4	20.6	20.6	22.0	20.6	1.4
6. R. C.	22.6	22.6	22.6	22.6	22.1	21.6	21.5	20.8	22.6	20.8	1.8
7. G. R.	25.3	23.8	23.0	22.8	24.6	23.9	22.3	21.6	22.8	21.6	1.2
8. J. A.	28.0	23.2	23.2	23.6	22.3	22.6	22.5	22.1	23.2	22.1	1.1
9. J. L.	28.0	25.7	23.6	23.5	25.1	23.4	23.1	22.4	23.5	22.4	1.1
10. M. H.	28.2	26.3	24.4	24.0	21.8	21.5	21.0	20.5	24.0	20.5	3.5
11. C. F.	29.9	26.8	26.1	26.0	24.4	23.5	22.3	21.7	26.0	21.7	4.3
12. M. B.	31.1	28.2	29.3	28.8	25.5	26.0	24.0	23.0	28.2	23.0	5.2
13. R. G.	29.9	29.9	31.9	30.9	26.9	26.8	24.7	23.2	29.9	23.2	6.7
Mean									23.57	21.39	
S.D.									2.88	1.04	

APPENDIX C

Table 12. Group B Test Results, Best Times, and Change.

Subject	Test I				Test II				Best Times		Change
	1	2	3	4	1	2	3	4	Pre	Post	
1. S. N.	21.8	21.1	21.5	20.5	20.4	21.5	20.0	19.1	20.5	19.1	1.4
2. D. W.	24.6	20.5	21.4	22.0	20.4	19.1	19.0	19.7	20.5	19.0	1.5
3. T. M.	22.2	25.1	21.7	22.8	22.5	22.0	21.2	20.5	21.7	20.5	1.2
4. B. S.	22.3	22.3	23.4	22.3	22.0	23.4	21.0	20.9	22.3	20.9	1.4
5. B. E.	24.3	23.5	22.5	22.4	20.2	21.7	19.5	19.2	22.4	19.2	3.2
6. M. G.	27.5	25.5	23.0	23.6	23.3	22.1	22.0	21.0	23.0	21.0	2.0
7. F. S.	24.5	23.1	25.9	23.0	22.4	21.9	22.6	22.0	23.0	21.9	1.1
8. S. E.	29.0	25.9	25.4	23.5	24.4	26.0	23.1	22.7	23.5	22.7	.8
9. G. R.	26.4	26.0	23.8	23.8	26.1	25.1	23.9	23.0	23.8	23.9	-.1
10. L. B.	25.5	24.4	24.6	26.1	26.1	26.1	25.0	28.0	24.4	25.0	-.6
11. G. L.	28.0	26.5	24.6	25.3	25.0	23.6	21.5	21.6	24.6	21.5	3.1
12. J. D.	29.9	26.0	25.2	24.6	23.0	22.5	22.0	21.5	24.6	21.5	3.1
13. B. C.	26.5	26.7	26.9	26.8	21.3	21.6	22.0	21.1	26.5	21.1	5.4
14. J. J.	30.0	34.2	35.1	30.0	26.4	26.5	24.2	24.2	30.0	24.2	5.8
Mean									23.63	21.54	
S.D.									2.46	.88	

APPENDIX C

Table 13. Group C Test Results, Best Times, and Change.

Subject	Test I				Test II				Best Time		Change
	1	2	3	4	1	2	3	4	Pre	Post	
1. D. W.	23.0	22.5	20.6	20.1	20.7	19.5	20.6	18.4	20.1	18.4	1.7
2. M. S.	25.0	19.9	20.8	22.3	21.1	20.5	19.3	19.9	20.8	19.3	1.5
3. G. H.	23.9	21.1	21.8	20.8	19.3	19.5	19.1	19.5	20.8	19.1	1.7
4. T. N.	25.8	23.8	22.6	22.0	22.2	22.0	20.7	20.5	22.0	20.5	1.5
5. B. H.	23.4	22.2	22.6	23.2	24.5	22.7	22.0	21.3	22.2	21.3	.9
6. G. B.	25.6	24.9	22.8	23.0	20.6	20.4	20.5	21.1	22.8	20.4	2.4
7. D. S.	23.8	24.6	23.0	23.4	22.6	21.7	21.3	21.8	23.0	21.3	1.7
8. K. K.	28.7	25.9	25.2	23.0	22.8	22.4	25.0	21.9	23.0	21.9	1.1
9. D. J.	26.4	24.1	23.3	23.0	20.6	20.4	24.0	19.9	23.0	19.9	3.1
10. C. R.	23.6	23.5	25.7	24.4	23.5	22.4	22.7	22.2	23.5	22.2	1.3
11. V. P.	26.3	26.3	24.5	23.9	22.9	23.1	22.9	22.1	23.9	22.1	1.8
12. T. S.	24.2	24.5	23.9	24.4	25.0	24.5	23.3	24.0	23.9	23.3	.6
13. J. S.	28.0	26.9	26.6	24.9	24.5	23.9	23.7	22.3	24.9	22.3	2.6
14. B. B.	30.5	29.8	28.4	28.4	28.8	25.5	24.2	23.2	28.4	23.2	5.2
Mean									23.02	21.09	
S.D.									2.04	1.53	

APPENDIX C

Table 14. Group D Test Results, Best Times, and Change.

Subject	Test I				Test II				Best Time		Change
	1	2	3	4	1	2	3	4	Pre	Post	
1. D. W.	21.4	21.5	21.5	20.1	24.0	21.6	22.3	21.1	20.1	21.1	-1.0
2. B. G.	23.7	21.3	22.6	22.6	22.0	20.0	20.2	21.0	21.3	20.0	1.3
3. H. H.	29.8	24.2	23.2	21.5	22.6	22.1	20.3	20.6	21.5	20.3	1.2
4. C. S.	22.6	22.2	22.0	22.2	23.2	24.8	25.0	26.0	22.0	23.2	-1.2
5. G. H.	23.6	22.3	22.4	22.5	21.2	20.6	20.9	20.3	22.3	20.3	2.0
6. C. W.	23.0	23.5	22.5	22.5	22.1	21.3	21.0	21.0	22.5	21.0	1.5
7. D. Z.	25.5	24.2	23.9	22.5	24.8	24.0	25.0	24.9	22.5	24.0	-1.5
8. D. R.	24.9	23.7	23.2	23.0	24.5	22.2	21.4	22.3	23.0	21.4	1.6
9. D. S.	23.9	23.4	24.4	25.0	23.0	21.3	21.4	22.2	23.4	21.3	2.1
10. T. M.	28.7	25.1	26.0	24.9	28.8	26.9	26.8	29.0	24.9	26.8	-1.9
11. K. E.	28.5	29.0	26.0	27.7	26.9	25.8	25.8	25.0	26.0	25.0	1.0
12. D. M.	35.9	29.0	26.9	27.0	24.8	24.1	24.6	25.0	26.9	24.1	2.8
13. R. M.	32.6	27.9	26.2	26.3	25.0	25.2	24.9	24.8	26.2	24.8	1.4
14. L. C.	36.3	27.5	30.5	28.3	32.4	29.5	28.3	27.5	27.5	27.5	.0
Mean									23.58	22.91	
S.D.									2.31	2.94	